(12) UK Patent Application (19) GB (11) 2 227 817 (13) A

(43) Date of A publication 08.08.1990

(21) Application No 8927621.6

(22) Date of filing 06.12.1989

(30) Priority data
(31) 3842077 (32) 14.12.1988 (33) DE

(71) Applicant
Diehl GmbH & Co

(Incorporated in the Federal Republic of Germany)

Stephanstrasse 49, 8500 Nurnberg,
Federal Republic of Germany

(72) Inventors
Ulrich Schleicher
Wolfgang Schwarz

(74) Agent and/or Address for Service
H N & W S Skerrett
Charles House, 148/9 Great Charles Street,
Birmingham, B3 3HT, United Kingdom

(51) INT CL[5]
F42B 13/16

(52) UK CL (Edition K)
F3A A2F

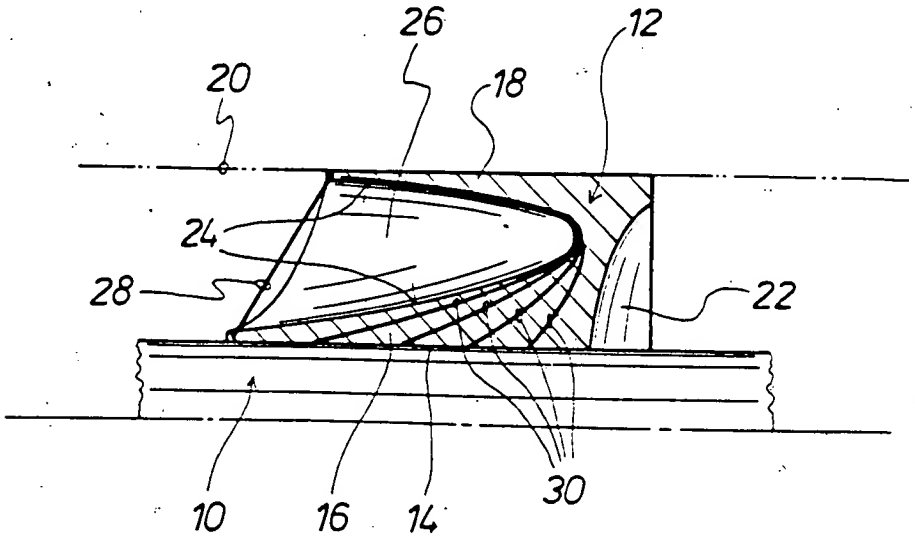
(56) Documents cited
GB 2207985 A EP 0190548 A EP 0152492 A1
US 4867067 A US 4040359 A US 3148472 A

(58) Field of search
UK CL (Edition J) F3A
INT CL[4] F42B 13/16

(54) Sabots

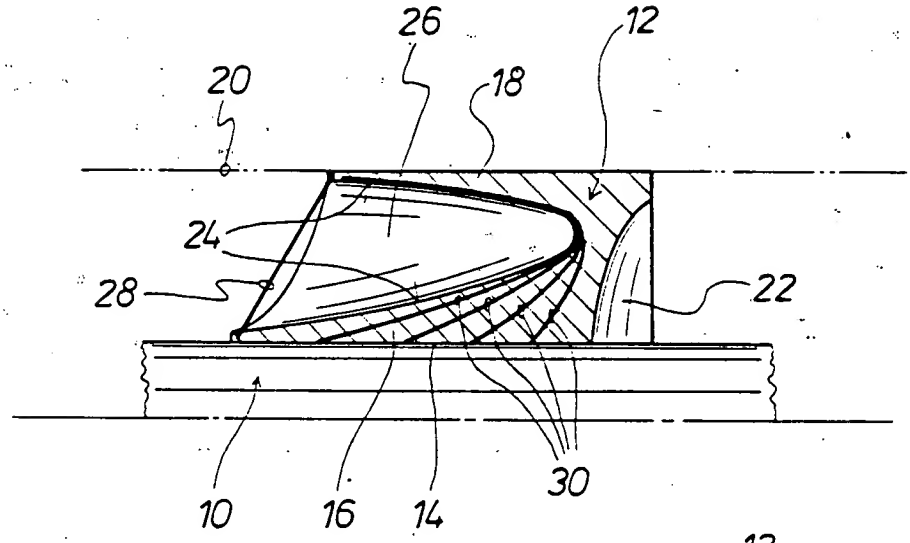
(57) A sabot 12 for a subcalibre projectile 10 has with the projectile 10 a common form-locking zone 14. The sabot 12 has, moreover, a gas-pressure absorption surface 24, an air pocket 22 and tension mechanisms 28, 30 for the absorption of tensile stresses which is connected to a central carrier part 16 adjacent to the projectile 10. In order to avoid undesired transverse forces leading to bending loads, the sabot 12 has, apart from the tension mechanism, membrane surfaces 24 which can be stressed in compression, so that mechanical stresses occuring in the sabot 12 are converted only into tensile and/or compression stresses. The tension mechanisms 28, 30 may comprise hair-shaped monocrystals of metals, oxides, borides, carbides, nitrides, graphite or diamond. The material of the sabot may be combustible so that its mass is progressively reduced as the projectile travels down the gun barrel. The form locking zone 14 may be such that, upon passage through a magnetic field at the muzzle of the gun, the mechanical connection between the sabot and the projectile is released. The sabot may be segmented.

FIG. 1



GB 2 227 817 A

FIG. 1



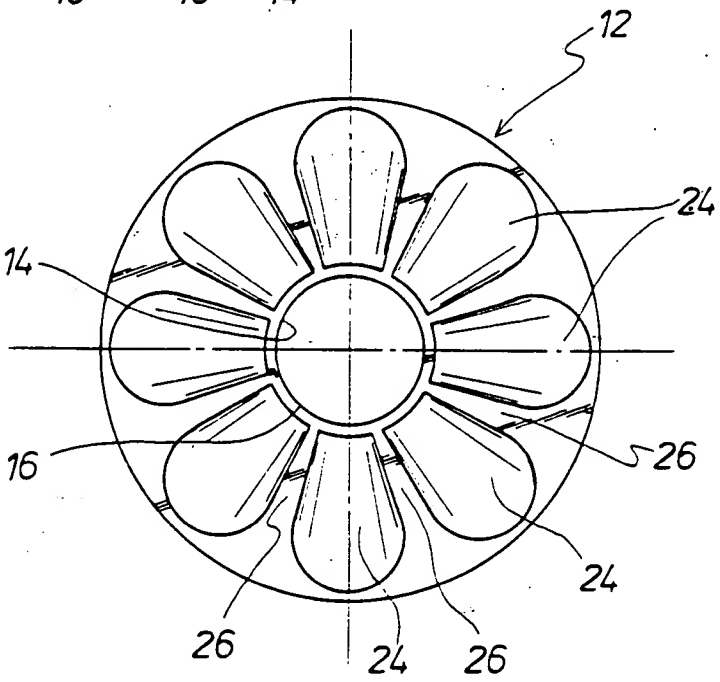


FIG. 2

A SABOT FOR A SUBCALIBRE PROJECTILE

This invention relates to a sabot for a subcalibre projectile. There is disclosed herein a sabot which has with the projectile a common form-locking zone, a gas-pressure absorption surface acted upon by propelling-charge gases, an air pocket for the utilisation of the air onflowing (incident air flow) after leaving the weapon barrel, and a tension mechanism for the absorption of tensile stresses, which mechanism is connected to a central carrier part adjacent to the projectile body.

Such a sabot is disclosed, for example, in DE 36 25 730 G2. In the case of this sabot the tension mechanism has a multiplicity of component parts which extend between two securing regions. The securing regions are designed with securing means which are fastened on the one hand to the central carrier part and on the other hand to the reverse of a front flange arranged on the carrier part. This sabot thus has a multiplicity of component parts, which tends to dictate considerable assembly expenditure.

An object of the present invention is to provide a sabot which is simply constructed and which, as a result of interior-ballistic measures, with a relatively low proportion of dead load has good load capacity.

According to the present invention there is provided a sabot for a subcalibre projectile which has with the projectile a common form-locking zone, a gas-pressure absorption surface for being acted upon by propelling-charge gases, an air pocket for utilising onflowing air after leaving a weapon barrel, and a tension mechanism for absorbing tensile stresses, which tension mechanism is connected to a central carrier part adjacent to the projectile, and in which the sabot has, apart from the tension mechanism, membrane surfaces which are stressable in compression, so that mechanical stresses occurring in the sabot are converted only into tensile or compression stresses.

Thus by the present invention the sabot has, apart from the tension mechanism, membrane surfaces which can be stressed in compression, so that the mechanical stresses occurring in the sabot are converted only into tensile or compression stresses (in order to avoid undesired transverse forces leading to bending loads). Thus, in the case of such a sabot, no transverse forces occur, but only tensile and/or compression stresses, which result in a damping effect, so that in advantageous manner the firing strength still appears to remain guaranteed. As a result of the avoidance of transverse forces or transverse stresses the sabot can be designed with seemingly minimum weight, so that a comparatively low dead-load proportion is the result.

The sabot is preferably designed with rib elements which are uniformly distributed around its circumference and which have, emanating from the form-locking zone or respectively from the carrier part, an increasing wall thickness in the radial direction. Said rib elements are connected to a common sliding element determining the outside diameter of the sabot, in which respect the gas-pressure absorption surface is more especially formed by recessed surfaces which are provided between adjacent rib elements. These recessed surfaces can be designed in the manner of compound-curve or catenary surfaces or be adapted to the shape of a portion of an egg-shell. Along a compound curve, i.e. in a compound-curve surface, no transverse forces occur, so that undesired bending stresses are avoided. This applies more especially also upon design of the recessed surfaces in the form of an egg-shell portion. In this respect seemingly with minimum weight or expenditure on material, optimum compressive strength may result.

The tension mechanism can be formed by tension elements which are anchored between the carrier part and the sliding element. These tension elements can be provided in the interior of the sabot, but it is also possible that additional tension elements span the recessed surfaces of the sabot.

It has proved to be expedient if the carrier part has a greater extent in the axial direction than the sliding element, and if the sliding element is offset or displaced in the axial direction from the carrier part towards the air pocket. In this respect, not only are comparatively large recessed surfaces which more especially absorb compressive loads realisable, but it is at the same time also possible to dimension the tension elements which absorb tensile stresses with sufficient length, as well as to form suitable air pockets.

The sabot can consist of fibres or "Whiskers". In this respect it can be a matter, for example, of an Al/Si oxide material, which can possess a tensile strength of several 1000 N/mm^2 (e.g. 5,000N/mm^2). Whiskers are hair crystals i.e. very fine hair-shaped monocrystals of metals, oxides, borides, carbides, nitrodes, graphite, diamond and so on, having diameters of up to 1µm and up to several millimetres in length. Since whiskers have an almost disturbance-free crystal structure they have excellent mechanical properties e.g. extremely high tensile strength.

One design of the sabot is characterised in that it consists of at least two segmental bodies. After leaving the weapon barrel the segmental bodies of the sabot separate from the projectile, so that the projectile alone homes in on its target. It is, however, also

possible for the sabot to have a form-locking zone which, upon passage through a magnetic field of specific minimum field strength, releases the mechanical connection between the sabot and the projectile. In this respect the magnetic field of specific minimum field strength is preferably situated at the barrel muzzle of the weapon barrel.

The connection between the projectile and the sabot in the common form-locking zone can be ensured by intermolecular forces such as, for example, by adhesion or cohesion or respectively by mechanical forces, as may be provided, for example, by looping around i.e. so that the projectile is surrounded by whiskers of the sabot. In this respect the whiskers are usually pre-stressed and lie embedded in the material of the sliding element. The sliding element may consist of a commercially-available, gas-tight, expanded plastics material.

The sabot may also have a combustible material. In this respect it is possible that the sabot is ignited by the propelling-charge gases. Thus, the advantages of a Travelling Charge Effect results and, moreover, a reduction in the sabot mass, so that the dead-load proportion is reduced. With a sabot of the last-mentioned type its combustion may be controlled in such a way that the projectile is guided well as far as the barrel muzzle of the projectile barrel, but possible

problems in the departure ballistics are extensively eliminated. Upon leaving the barrel muzzle of the weapon barrel such a sabot may comprise, for example, only a skeleton or frame with an air pocket.

An embodiment of a sabot in accordance with the present invention will now be described, by way of example only, with reference to the accompanying diagrammatic drawings, in which:-

FIGURE 1 shows a half longitudinal section through a sabot, and

FIGURE 2 shows a rear view of the sabot.

FIGURE 1 shows a half-sectional portion of a projectile 10 and a half-sectional axial longitudinal section through a sabot 12 arranged on the projectile 10. A common form-locking zone 14 is present between the sabot 12 and the projectile 10. The sabot 12 has in the vicinity of the projectile 10 a carrier part 16 and, on the side radially remote from the carrier part 16, a sliding element 18. The sliding element 18 determines the outside diameter of the sabot 12. The calibre or bore of a weapon barrel is indicated by a thin dot-dash line designated by the reference number 20.

The sabot 12 is provided on the nose side or front side between the sliding element 18 and the carrier part 16 with an air pocket 22. Formed on the rear part of the sabot 12 remote from the air pocket 22 is a gas-pressure absorption surface, which is more especially afforded by recessed or membrane surfaces 24.

As is evident from FIGURE 2, provided in a uniformly distributed manner around the circumference of the sabot 12 are a number of recessed or indentation surfaces 24. Adjacent recessed surfaces 24 are spatially separated from one another by rib elements 26. The rib elements 26 have, emanating from the carrier part 16 or from the form-locking zone 14, an increasing wall thickness, in which respect the surfaces 24 can be designed as compound-curve (or catenary) surfaces or as an egg-shell portion. In surfaces 24 designed in such a way, only compressive loads occur, whilst undesired transverse forces, which may lead to bending stresses, are avoided. Occurring tensile stresses of the sabot 12 are absorbed by tension mechanisms, in the case of which it is a matter of tension elements 28 or 30 respectively. Tension elements 28,30 consist of whiskers. The tension elements 28 are anchored between the carrier part 16 and the sliding element 18 of the sabot 12 and they span the recessed surfaces 24, as is evident from FIGURE 1. In FIGURE 2 the representation of the tension elements 28 has been dispensed with. The tension elements 30 are

arranged in the interior of the sabot 12, and they extend between the carrier part 16 through the ribs 26 towards the sliding element 18, in which respect they can extend offset or displaced azimuthally in the sliding element 19. The whiskers are pre-stressed and lie embedded in the material of the sliding element 18. The sliding element consists of a commercially available gas-tight, expanded plastics material.

It is to be appreciated that the present invention offers may improvements at least some of which might be patentable individually or in combination. Any individual feature as aforementioned or as shown or implicit herein or combinations thereof, or functions or methods appertaining thereto, may be patentably inventive and any specific term as used herein should not be construed as unnecessarily or unduly limiting; the scope of such a term should extend to, or may be replaced or supplemented by, any reasonable equivalent or generic expression. Additionally, any range mentioned herein for any variable or parameter shall be taken to include a disclosure of any derivable sub-range within that range or of any particular value of the variable or parameter arranged within, or at an end of, the range or sub range.

Therefore, further according to the present invention there is provided a sabot for a sub-calibre projectile, said sabot being securable to the projectile

and having a gas pressure absorption surface, and preferably a tension mechanism for absorption of tensile stresses, said sabot having membranes for damping or damping out transverse or radial forces or for avoiding bending loads.

The gas pressure absorption surface may be provided by a multiplicity of recesses between rib elements and usually an air pocket will be provided for using or spreading incident air flow on exit of the projectile from a weapon barrel.

CLAIMS

1. A sabot for a subcalibre projectile which has with the projectile a common form-locking zone, a gas-pressure absorption surface for being acted upon by propelling-charge gases, an air pocket for utilising onflowing air after leaving a weapon barrel, and a tension mechanism for absorbing tensile stresses, which tension mechanism is connected to a central carrier part adjacent to the projectile, and in which the sabot has, apart from the tension mechanism, membrane surfaces which are stressable in compression, so that mechanical stresses occurring in the sabot are converted only into tensile or compression stresses.

2. A sabot according to claim 1, which is designed with rib elements that are distributed uniformly around the circumference of the sabot and which rib elements have, emanating from the form-locking zone or from the carrier part, an increasing wall thickness, in the radial direction of the sabot, and which are connected to a common sliding element determining the outside diameter of the sabot, and the gas-pressure absorption surface is formed, for example, by recessed surfaces provided between adjacent rib elements.

3. A sabot according to claim 2, in which the recessed surfaces are designed in the manner of compound-curve or catenary surfaces.

4. A sabot according to claim 2, in which the recessed surfaces are adapted to the shape of a portion of an egg-shell.

5. A sabot according to any one of the preceding claims, in which the tension mechanism is formed by tension elements which are anchored between the carrier part and the sliding element.

6. A sabot according to claim 5, in which the tension elements (e.g. 30) are provided in the interior of the sabot.

7. A sabot according to claim 5, in which the tension elements (e.g. 28) span the recessed surfaces.

8. A sabot according to any one of the preceding claims, in which the carrier part, in the axial direction of the sabot, has a greater extent that the sliding element, and in that the sliding element is offset or displaced in the axial direction against the carrier part towards the air pocket.

9. A sabot according to any one of claims 1 to 8, which consists of at least two segmental bodies.

10. A sabot according to any one of claims 1 to 8, in which the form-locking zone is such that upon passage through a magnetic field of a specific minimum field strength the mechanical connection between the sabot and the projectile is released.

11. A sabot according to any one of claims 1 to 8, having or comprising a combustible material.

12. A sabot according to claim 1, in which the tension mechanism consists of whiskers, for example, of an Al/Si oxide material.

13. A sabot for a subcalibre projectile substantially as herein described with reference to the FIGURES of the accompanying drawings.

14. A projectile including a sabot as claimed in any one of the preceding claims.

Published 1990 at The Patent Office, State House, 66/71 High Holborn, London WC1R 4TP. Further copies may be obtained from The Patent Office Sales Branch, St Mary Cray, Orpington, Kent BR5 3RD. Printed by Multiplex techniques ltd, St Mary Cray, Kent, Con 1/87